

XI. Antalya Cebir Günleri

Antalya, Türkiye

20–24 Mayıs 2009



WELCOME to Antalya Algebra Days XI, May 20–24, 2009.

It is hard to believe that a decade has already passed since we gathered in a bar-converted-to-classroom at Falcon Hotel, pulled the curtains and started timidly a conference among ourselves. We then jokingly called it the *first* Antalya Algebra Days. This year we are overwhelmed with exhilaration in welcoming you to the *second* decade of Antalya Algebra Days.

Our dream then was to act under the disguise of helping graduate students to find an opportunity for international contact. We pretended that we would strive to create for them an environment where they would hear about the most recent developments in algebra and find opportunities for international collaboration. I can now admit that we did it all for ourselves. That so many graduate students also benefited from these efforts as much as we did is just a happy coincidence.

Antalya provides an excellent environment for mathematics; everybody thinks you are on vacation and leaves you alone while you can do mathematics without being interrupted. I am hoping that this year we will once again exploit this opportunity.

All the invited speakers this year agreed to participate through their own funds. My two young colleagues Özgün and Müfit in the organizing committee undertook several boring but somebody-must-do-it chores with good humor. Ergün undertook the annoying task of dealing with bureaucracy to fund young speakers. David, as usual, did a superb job with the web and with this booklet. His patience, good humor and common sense helped me to see solutions at times of doom and gloom.

This year TÜBİTAK is funding young participants. Bilgi University, through the personal efforts of Ali Nesin, is again providing us with stationery. Tivrona Tours, through the smooth professionalism of Tamer Koç and Şükran Demir, continue to provide an excellent service. And the Turkish Mathematical Society once again provided financial support for unforeseen expenses. We gratefully acknowledge all the help and support we are receiving.

So welcome all to Antalya. Let the festivities begin!

Ali Sinan Sertöz
meeting coordinator

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1 Invited talks

Commuting matrices and spaces of homomorphisms

Alejandro Adem

Let G denote a Lie group, and consider the space of all commuting n -tuples of elements in G . In this talk we will discuss basic topological properties of spaces such as these, and how they relate to bundle theory, group cohomology and other interesting topological invariants.

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Square-zero matrices over commutative rings

Luchezar Avramov

We will discuss $n \times n$ matrices A with $A^2 = 0$ over a commutative ring R containing a field, k . The condition on A guarantees that $\text{col}(A)$, the space of A -linear combinations of columns of A , is contained in $\text{nul}(A)$, the set of solutions of the system of linear equations $AX = 0$.

The following question is open even when R is a polynomial ring in $d \geq 4$ variables over k : If A is upper triangular and $\text{col}(A)$ has finite, non-zero codimension in $\text{nul}(A)$, then does one have $n \geq 2^d$? The talk will review the origins of such a strange statement (in studies of torus actions on CW complexes), its extension to noetherian commutative rings (where it ties up with major unsolved problems in the field), the partial results obtained (concerning the block structure of A), and the techniques used to prove them (from an unwritten prequel to homological algebra).

The talk is based on joint work with Ragnar-Olaf Buchweitz, Srikanth Iyengar, and Claudia Miller.

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Fibred biset functors

Robert Boltje

In joint work with Olcay Coşkun, we introduced the notion of a fibred biset functor, generalizing Bouc's biset functors. Biset functors are functors on a category whose objects are finite groups and whose morphisms are given by the Grothendieck group of bisets, i.e., finite sets with commuting left and right actions of the respective groups. This set of morphisms can be identified with the Burnside group of the direct product of the two finite groups. Biset functors generalize global Mackey functors by including inflation and deflation maps in a very natural way. A fibred biset functor is defined on a similar category, with the morphism set changed to the Grothendieck group of monomial representations (which contains the Burnside group). A standard example is the character ring functor. In the talk we will introduce the notion of a biset functor, classify the simple biset functors, and give examples.

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What is an ultraproduct?

Alexandre Borovik

The ultraproduct is a very useful, powerful, and in the same time somewhat mysterious way of constructing algebraic objects. I will give a very informal introduction into ultraproducts and the Łoś Theorem.

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Generic kernels and modules of constant Jordan type

Jon F. Carlson

This is joint work with Eric Friedlander, Julia Pevtsova and Andrei Suslin. We consider modules over an elementary abelian group on which every element in the radical, but not the square of the radical, has the same Jordan canonical form. Such modules can be used to define bundles on projective spaces and Grassmannians. They have many interesting properties. Every module over the group algebra contains several of these as submodules. They lead us to define certain canonical submodules which are called generic kernels and images. In this talk I will discuss some of the constructions and their generalizations.

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What is Schubert calculus?

İzzet Coşkun

I will introduce Schubert calculus in the context of the cohomology ring of Grassmannians. The structure constants of the cohomology of Grassmannians are often called Littlewood-Richardson coefficients and they have many interpretations in representation theory and combinatorics. Time permitting, I will describe Schubert calculus for other homogeneous varieties such as flag varieties and orthogonal Grassmannians.

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On moduli spaces of quivers

Mátyás Domokos

We shall review the concept of moduli spaces of representations of quivers, and discuss some results on singularities of such moduli spaces.

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Computational group cohomology and commutative algebra

David J. Green

The mod- p cohomology ring of a finite group is a finitely presented graded commutative algebra. Many results and conjectures link commutative algebra invariants of the cohomology ring to the subgroup structure of the group. One way to test existing conjectures and develop new ideas is to calculate as many cohomology rings as possible. Simon King and I have computed the mod-2 cohomology rings of all 2328 groups of order 128. Following Carlson, the cohomology of a p -group can be computed from a sufficiently large initial segment of the minimal resolution. We used the computer algebra system Sage in order to allow high-speed communication between methods for commutative algebra (Singular), group theory (Gap) and homological algebra (C MeatAxe). Noncommutative Groebner bases provide an efficient way to construct the resolution.

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What is known about K_2 of curves?

Rob de Jeu

As a special case, the Beilinson conjectures predict a relation between the regulator of (a part of) K_2 of a curve over a number field and the value of its L -function at 2. We discuss this conjecture, how one can describe the part of the K -group, various results that corroborate the conjecture, as well as some general results about the kernel of the *tame symbol*.

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What Are Border Bases?

Martin Kreuzer

Border bases are a generalization of Groebner bases and have been introduced for zero-dimensional polynomial ideals. They offer a number of advantages:

- (1) numerical stability,
- (2) symmetry preservation, and
- (3) explicit equations for the moduli space.

After introducing the basic definitions and properties of border basis theory, we focus on some recent advances in the study of their moduli space, the border basis scheme. In particular, we give explicit constructions of its principal component and of various kinds of flat families of ideals which can be used to deform one zero-dimensional ideal to another.

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The evolution of algebraic cycles: A 30 year reflection from a transcendental geometer

James D. Lewis

I will explain the intertwining role of Hodge theory and algebraic cycles, beginning from the classical era to the more recent developments using arithmetical normal functions.

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Left quasi-morphic rings

W. K. Nicholson

This is joint work with V. Camillo and Z. Wang.

An element a in a ring R is called left morphic if the “dual of the isomorphism theorem” holds for the map $r \mapsto ra$, that is if $R/Ra \cong \mathbf{1}(a)$ where $\mathbf{1}(x)$ is the left annihilator; this condition holds if and only if there exists $b \in R$ such that $Ra = \mathbf{1}(b)$ and $\mathbf{1}(a) = Rb$. The ring R is called a *left morphic ring* if every element is left morphic.

We relax this condition and say that a ring R is *left quasi-morphic* if, for each $a \in R$, there exist b and c in R such that $Ra = \mathbf{1}(b)$ and $\mathbf{1}(a) = Rc$. Examples include left morphic rings and (von Neumann) regular rings. Our first theorem is an extension of a basic result of von Neumann about regular rings: In a left quasi-morphic ring, the set $\mathcal{L}(R)$ of all principal left ideals forms a lattice, that is finite intersections and finite sums of principal left ideals are again principal. This leads to structure theorems when mild finiteness conditions are imposed. In particular we obtain our second theorem: A ring R is an artinian principal ideal ring (two-sided) if and only if R is a left and right quasi-morphic ring in which the lattice $\mathcal{L}(R)$ has the ACC (equivalently the DCC).

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Hypersurfaces and the Weil conjectures

Anthony J. Scholl

This talk is about Weil’s famous conjectures on the number of points of a variety over a finite field. We review the history of the conjectures, and describe some new results related to the case of hypersurfaces.

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Zariski pairs and lattice theory

Ichiro Shimada

For simplicity, we restrict ourselves to complex projective plane curves B whose singular locus $\text{Sing}B$ consists of only simple singularities. We introduce three equivalence relations among (reduced, possibly reducible) projective plane curves of a fixed degree.

Definition. Let B and B' be projective plane curves with only simple singularities.

1. We write $B \sim_{\text{eqs}} B'$ if B and B' are contained in the same connected component of an equisingular family of plane curves.
2. We say that B and B' are of the *same configuration type* and write $B \sim_{\text{cfg}} B'$ if there exist tubular neighborhoods $T \subset \mathbb{P}^2$ of B and $T' \subset \mathbb{P}^2$ of B' and a homeomorphism $\varphi : (T, B) \xrightarrow{\sim} (T', B')$ such that $\deg \varphi(B_i) = \deg B_i$ holds for each irreducible component B_i of B , that φ induces a bijection $\text{Sing}B \xrightarrow{\sim} \text{Sing}B'$, and that φ is an analytic isomorphism of plane curve singularities locally around each $P \in \text{Sing}B$.
3. We say that B and B' have the *same embedding topology* and write $B \sim_{\text{emb}} B'$ if there exists a homeomorphism $\psi : (\mathbb{P}^2, B) \xrightarrow{\sim} (\mathbb{P}^2, B')$ such that ψ induces a bijection $\text{Sing}B \xrightarrow{\sim} \text{Sing}B'$ and that, locally around each $P \in \text{Sing}B$, ψ is an analytic isomorphism of plane curve singularities.

It is obvious that

$$B \sim_{\text{eqs}} B' \implies B \sim_{\text{emb}} B' \implies B \sim_{\text{cfg}} B'.$$

Definition. A *Zariski pair* is a pair $[B, B']$ of projective plane curves of the same degree with only simple singularities such that $B \sim_{\text{cfg}} B'$ but $B \not\sim_{\text{emb}} B'$.

Example. Zariski [6] showed that there are irreducible plane curves B and B' of degree 6 with six ordinary cusps such that $\pi_1(\mathbb{P}^2 \setminus B)$ is non-abelian while $\pi_1(\mathbb{P}^2 \setminus B')$ is abelian. The curve B is defined by a homogeneous equation of the form $f^3 + g^2 = 0$, where f and g are polynomials of degree 2 and 3, respectively. An explicit defining equation of B' was given by Oka [1]. See also [2].

It is easy to determine whether or not two plane curves are of the same configuration type; while it is not so simple to determine whether or not they have the same embedding topology. Our aim is to show that a certain sublattice of the Néron-Severi lattice of the smooth minimal surface birational to the double cover of \mathbb{P}^2 branching along the plane curve provides us with a strong tool to distinguish the topological type of the embedding. The details (for curves of degree 6) are given in [4] and in [5].

A *lattice* is a free \mathbb{Z} -module L of finite rank with a non-degenerate symmetric bilinear form

$$L \times L \rightarrow \mathbb{Z}.$$

Let $B \subset \mathbb{P}^2$ be a projective plane curve of even degree such that $\text{Sing}B$ consists of simple singularities of *ADE*-type R_B . Let $Y_B \rightarrow \mathbb{P}^2$ be the double covering of \mathbb{P}^2 branching along B . Then the singular points of Y_B are rational double points of *ADE*-type R_B . Let $X_B \rightarrow Y_B$ be the minimal resolution of these rational double points. We regard $H^2(X_B, \mathbb{Z})$ as a lattice by the cup-product. Let

$$\Sigma_B \subset H^2(X_B, \mathbb{Z})$$

be the sublattice generated by the classes of the exceptional (-2) -curves of the resolution $X_B \rightarrow Y_B$ and the class of the pull-back of a line of \mathbb{P}^2 . We then denote by

$$\Lambda_B \subset H^2(X_B, \mathbb{Z})$$

the primitive closure of Σ_B , and by

$$T_B \subset H^2(X_B, \mathbb{Z})$$

the orthogonal complement of Λ_B .

Theorem. *The isomorphism class of the lattice T_B is an invariant of the homeomorphism type of (\mathbb{P}^2, B) .*

Corollary. *Suppose that $B \sim_{\text{cfg}} B'$ and $|\Lambda_B/\Sigma_B| \neq |\Lambda_{B'}/\Sigma_{B'}|$. Then $[B, B']$ is a Zariski pair.*

We investigate the finite abelian groups Λ_B/Σ_B in relation with the geometry of the embedding $B \hookrightarrow \mathbb{P}^2$ (for example, existence of plane curves of low degrees passing through singular points of B).

As another application of the theorem, we construct examples of arithmetic Zariski pairs:

Definition. An *arithmetic Zariski pair* is a Zariski pair $[B, B^\sigma]$, where B is defined over $\overline{\mathbb{Q}}$ and B^σ is the conjugate of B by an element $\sigma \in \text{Gal}(\overline{\mathbb{Q}}/\mathbb{Q})$.

For the construction of examples of arithmetic Zariski pairs in degree 6, we need the arithmetic theory of transcendental lattices of singular $K3$ surfaces developed in [3].

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On the Castelnuovo-Mumford regularity of cohomology and invariant rings

Peter Symonds

We discuss the properties of the Castelnuovo-Mumford regularity of a graded module and how it can be used to give bounds on the degrees of the generators and relations.

We then mention some of the ideas in the proofs of two results.

1. The regularity of a ring of polynomial invariants under the action of a finite group is at most 0, even in finite characteristic. Hence the ring is generated in degrees at most $n(|G| - 1)$ (where n is the number of variables and G is the group).
2. The regularity of the cohomology of a finite group is exactly 0.

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The universal arithmetic curve

Muhammed Uludağ

I will discuss the limit space F of the category of coverings C of the “modular interval” as a deformation retract of the universal arithmetic curve, which is by (my) definition nothing but the punctured solenoid S of Penner. The space F has the advantage of being compact, unlike S . A subcategory of C can be interpreted as ribbon graphs, supplied with an extra structure that provides the appropriate morphisms for the category C . After a brief discussion of the mapping class groupoid of F , and the action of the Absolute Galois Group on F , I will turn into a certain “hypergeometric” galois-invariant subsystem (not a subcategory) of genus-0 coverings in C . One may define, albeit via an artificial construction, the “hypergeometric solenoid” as the limit of the natural completion of this subsystem to a subcategory. Each covering in the hypergeometric system corresponds to a non-negatively curved triangulation of a punctured sphere with flat (euclidean) triangles. The hypergeometric system is related to plane crystallography. Along the way, I will also discuss some other natural solenoids, defined as limits of certain galois-invariant genus-0 subcategories of non-galois coverings in C .

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Mixed Tate motives over dual numbers

Sinan Ünver

We will give surveys of two different constructions of the category of mixed Tate motives: one due to Nori and the other one due to Beilinson, Goncharov, Schechtman, and Varchenko. We will relate this to Hilbert's 3rd problem and the Bloch-Suslin complex over the dual numbers. Finally we will construct the additive dilogarithm on the Bloch-Suslin complex and explain how it relates to the volume map on the Euclidean scissors congruence groups.

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2 Contributed Talks

Quasi-permutation representations of p -groups enjoy Hasse principle

Mohammad Hasan Abbaspour

By a quasi-permutation matrix we mean a square matrix over the complex field \mathbb{C} with non-negative integral trace. Thus every permutation matrix over \mathbb{C} is a quasi-permutation matrix. For a given finite group G , let $p(G)$ denote the minimal degree of a faithful permutation representation of G (or a faithful representation of G by permutation matrices), let $q(G)$ denote the minimal degree of a faithful representation of G by quasi-permutation matrices over the rational field \mathbb{Q} , and let $c(G)$ denote the minimal degree of a faithful representation of G by complex quasi-permutation matrices. It is easy to see that

$$c(G) \leq d(G) \leq p(G)$$

where G is a finite group. A finite group G is said to enjoy Hasse principle if every conjugacy preserving automorphism of G is an inner automorphism. In [2], for any prime p , all finite non-abelian p -groups of order p^m having cyclic subgroups of order p^{m-2} but having no normal cyclic subgroup of order p^{m-2} and no element of order p^{m-1} are classified and shown that all enjoy Hasse principle. In this paper, we study characters and quasi-permutation representations of these groups.

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Divisor class groups of certain non-commutative rings

Evrin Akalan

In commutative algebra and number theory the class group of a Krull Domain plays an important role. Roughly speaking, it measures the lack of unique factorisation in the ring. In the non-commutative case there are different possibilities to define the divisor class group. We investigate Noetherian maximal orders with enough invertible ideals and their two different divisor class groups. We also investigate relations between the class groups of the ring and the divisor class group of the center of the ring. We provide examples to illustrate our results.

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Essential cohomology of elementary abelian p -groups

Fatma Altunbulak Aksu

The talk will be a presentation of a joint work with David J. Green [1]. Let G be a finite group, k be a field of characteristic p and let $H^*(G, k)$ denote the cohomology ring of G . The essential cohomology of G , denoted by $\text{Ess}(G)$, is the ideal in $H^*(G, k)$ consisting of the cohomology classes which restrict trivially on all proper subgroups of G . In this work, we study the essential cohomology of an elementary abelian p -group in the case of odd primes.

Let V be an elementary abelian p -group of rank n . It is well-known that for an odd prime p , the cohomology ring of V is polynomial tensor exterior, i.e. $H^*(V, k) = k[x_1, \dots, x_n] \otimes_k \wedge(a_1, \dots, a_n)$. We show that $\text{Ess}(V)$ is the Steenrod closure of the class $a_1 \cdots a_n$. That is $\text{Ess}(V)$ is the smallest ideal which contains the class $a_1 \cdots a_n$ and is closed under the action of Steenrod algebra.

Our second result concerns the structure of $\text{Ess}(V)$ as a module over the polynomial subalgebra $k[x_1, \dots, x_n]$. An elementary abelian p -group is also a vector space over \mathbb{F}_p and there is a natural action of $\text{GL}(V)$ on the cohomology ring $H^*(V, k)$. We prove that the essential ideal $\text{Ess}(V)$ is free on the set of Mui. invariants which are the $\text{SL}(V)$ -invariants of the natural action of $\text{GL}(V)$ on the cohomology ring $H^*(V, k)$.

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The hive model and Littlewood-Richardson coefficients

Murat Altunbulak

In this talk I will describe the so called hive model given by Knutson and Tao [1] (see also [2]), and its connection with the Littlewood-Richardson coefficients which describe the irreducible components V_ν of the tensor product $V_\lambda \otimes V_\mu$ of irreducible representations V_λ and V_μ of $GL_n(\mathbb{C})$.

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IFP ideals in near-rings

Akın Osman Atagün

A near-ring N is called an IFP near-ring provided that for all $a, b, n \in N$, $ab = 0$ implies $anb = 0$. In this study, the IFP condition in a near-ring is extended to the ideals in near-rings. If N/P is an IFP near-ring, where P is an ideal of a near-ring N , then we call P as the IFP-ideal of N . The relations between prime ideals and IFP-ideals are investigated. It is proved that a right permutable or left permutable equiprime near-ring has no non-zero nilpotent elements and then it is obtained that if N is a right permutable or left permutable finite near-ring, then N is a near-field if and only if N is an equiprime near-ring. Also, it is attracted attention that the concept IFP-ideal is seen naturally in some near-rings like that p-near-rings, Boolean near-rings, weakly (right and left) permutable near-rings, left (right) self distributive near-rings, left (right) strongly regular near-rings and left (w-) weakly regular near-rings.

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A note on the factorisation of (m, r) -potent elements in T_n

Sevgi Atlıhan

The *index* and *period* of an element a of a finite semigroup are the smallest values of $m \geq 1$ and $r \geq 1$ such that $a^{m+r} = a^m$. An element with index m and period 1 is called an m -potent element. In [1], for an element α of a finite full transformation semigroup with index m and period r , the authors obtained an unique factorisation $\alpha = \sigma\beta$ such that $Shift(\sigma) \cap Shift(\beta) = \emptyset$, where σ is a permutation of order r and β is an m -potent element. The main aim of this article is to research in the case $n = m + r$, whether the condition $Shift(\sigma) \cap Shift(\beta) = \emptyset$ can be removed or not. In this paper, to remove the condition first, the case $n = m + r$ is characterized. Next, it is given the main theorems .

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Dead virtual permutation sets and the Tornehave morphism

Laurence Barker

The idea behind the theory of group functors is to study certain familiar structures, such as character rings and Burnside rings, by realizing those structures as modules of algebras generated by suitable maps, for instance, induction and inflation maps. In this context, a symplectic map introduced long ago by J. Tornehave can be realized as a ring homomorphism and, moreover, it induces a recently discovered isomorphism of S. Bouc concerning real characters modulo rational characters.

(References: *Tornehave morphisms I, II, III*, submitted for publication, available on homepage.)

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On totally inert groups

Cansu Betin

A subgroup H of a group G is called **inert**, if the index $|H : H \cap H^g|$ is finite for any element g in G . A group all of whose proper subgroups are inert is called **totally inert**. The class of totally inert groups is quite large and complex. It contains Dedekind groups, quasi-finite groups (in particular Tarski monsters), and the class of FC-groups properly. Recently, this topic is studied by several authors [1, 2, 4]. Belyaev-Kuzucuoglu-Seçkin have shown that no infinite locally finite simple group is totally inert [2]. Robinson investigated the structure of soluble totally inert groups [4].

In this work [3], we study simple totally inert groups and the structure of minimal-non-FC totally inert groups.

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The solutions of the exponential diophantine equation

$$x^2 + 2^a \cdot 3^b \cdot 11^c = y^n$$

İsmail Naci Cangül

This is joint work with Gökhan Soydan and Musa Demirci. We give all non-negative integer solutions $a, b, c, x, y \geq 1, n \geq 3$ with x and y coprime, of the exponential Diophantine equation $x^2 + 2^a \cdot 3^b \cdot 11^c = y^n$. For $n = 3, 4, 6, 12, 24$, we transform the above equation into several elliptic equations written in cubic or quartic models for which we determine all of their $\{2, 3, 11\}$ -integer points. For $n \geq 5$, we apply a method that uses primitive divisors of Lucas sequences. Again we are able to obtain several elliptic equations written in cubic models for which we find all their $\{2, 3, 11\}$ -integer points. All the Computations are done with MAGMA [7].

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The ring of subquotients of a finite group

Olcaý Coşkun

In this talk we introduce the ring $\Lambda(G)$ of subquotients of a finite group G . As an abelian group, it is free on the set of conjugacy classes of subquotients (i.e. sections) of the group G . Alternatively it is the Grothendieck group of the category of *pure bisets* and in this case the ring structure comes from a new composition product of bisets. The ring of subquotients is connected to the representation ring of the Mackey algebra for G by a *linearization map* which has similar properties as the well-known linearization map from the Burnside ring of G to the representation ring of G .

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Constacyclic and cyclic codes over $F_{2^k} + uF_{2^k} + u^2F_{2^k}$

Yasemin Çengellenmiş

It is extended the result of [4] to codes over the commutative ring $F_{2^k} + uF_{2^k} + u^2F_{2^k}$ where $k \in \mathbb{N}$ and $u^3 = 0$. In [2], a new Gray map between codes over $F_{2^k} + uF_{2^k} + u^2F_{2^k}$ and F_{2^k} was defined. It was proved that the Gray image of the linear $(1 - u^2)$ -cyclic code over the commutative ring $F_{2^k} + uF_{2^k} + u^2F_{2^k}$ of length n is a distance-invariant quasicyclic code of index 2^{2k-1} and the length $2^{2k}n$ over F_{2^k} . In here, it is proved that if $(n, 2) = 1$, then every code of length $2^{2k}n$ over F_{2^k} which is the Gray image of a linear cyclic codes of length n over $F_{2^k} + uF_{2^k} + u^2F_{2^k}$ is permutation equivalent to a quasi-cyclic code of index 2^{2k-1} .

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On the number of solutions of quadratic equations

Alex Degtyarev

This is a joint work with I. Itenberg and V. Kharlamov.

We discuss the classical problem on the number of connected components of an intersection of real quadric in a real projective space. In spite of the fact that all equations are quadratic, we show (by considering a few simple boundary cases) that the problem is much more difficult than it seems and that the ‘obvious’ bounds that one may conjecture fail.

Our principal results concern an ‘advanced’ boundary case, namely, intersections of three real quadrics. Let $B_2^0(N)$ be the maximal number of connected components that a regular complete intersection of three real quadrics in \mathbb{P}^N can have. We prove that $B_2^0(N)$ differs at most by one from the maximal number $\text{Hilb}(d)$ of ovals of the submaximal depth $[(N-1)/2]$ of a real plane projective curve of degree $d = N + 1$. As a consequence, we obtain the bounds

$$\frac{1}{4}N^2 + O(N) < B_2^0(N) < \frac{3}{8}N^2 + O(N).$$

In particular, our result implies that there is no uniform bound on the number of connected components of an intersection of real quadrics depending only on the codimension of the intersection.

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Comments on the Fibonacci sequences in finite groups

Ömür Deveci

In the work of Steven W. Knox, the claim is made that “A k-nacci sequence in a finite group is simply periodic [1].” We provide an example to demonstrate that the claim is false. This is joint work with Erdal Karaduman, also of Atatürk University.

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On one general method of describing all idempotents of the semigroup $B_X(D)$ and defining their number

Ya. Diasamidze

Let X be an arbitrary set, D be an arbitrary X -semilattice of unions, and X be a complete semigroup of binary relations which is defined by the complete X -semilattice of unions D (see [1]).

It is obvious that any idempotent of the semigroup $B_X(D)$ is a right unit of some subsemigroup of this semigroup. Hence it follows that the union of the set of all right units of all those subsemigroups of the semigroup $B_X(D)$ which possess right units coincides with the set of all idempotent elements of the semigroup $B_X(D)$.

Let us describe the method of investigation of idempotent elements of the semigroup $B_X(D)$. The method consists of the following stages of investigation of the semilattice D and the semigroup $B_X(D)$.

a) the description of the set of all semilattices of the semilattice D ;

b) the choice of all XI -semilattices, i.e., all semilattices D' for which the semigroup $B_X(D')$ possesses a right unit, from the set of all subsemilattices of the semilattice D of the set Σ_D .

Note that in [2] the method was worked out, which enables one to determine whether the finite X -semilattice of unions is or is not a XI -semilattice.

c) The partitioning of the set Σ_D into classes, in everyone of which only isomorphic semilattices of the set Σ_D are connected with one another. The set of representatives of these classes is denoted by Σ_{XI} .

d) the description of all right units of the semigroup $B_X(D')$ for any semilattice $D' \in \Sigma_{XI}$.

Note that there exists the method of describing right units of the semigroup $B_X(D')$. Also, for a finite set X the method has been worked out, which makes it possible to derive formulas for calculating the number of all right units of the semigroup $B_X(D')$ (see [3]).

e) The description of all idempotents of the semigroup $B_X(D)$.

For this, assuming that $\emptyset \notin D$, it is sufficient to combine in a single theorem all conditions of describing the right units of those semigroups $B_X(D')$ for which $D' \in \Sigma_{XI}$, while, assuming that $\emptyset \in D$, it is necessary to combine in one theorem all conditions of describing the right units of those semigroups $B_X(D')$ for which $D' \in \Sigma_{XI}$ and $\emptyset \in D'$.

f) The derivation of formulas for calculating the number of idempotent elements of the semigroup $B_X(D)$ when X is a finite set.

For this, assuming that $\emptyset \notin D$, for any $D' \in \Sigma_D$ it is sufficient to sum the numbers of right units of semigroups $B_X(D')$, while, assuming that $\emptyset \in D$, it is necessary to sum the numbers of right units only of those semigroups $B_X(D')$ for which $\emptyset \in D'$ (see [3]).

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Separating invariants and finite reflection groups

Emilie Dufresne

The study of separating invariants has become quite popular in the recent years. In the case of finite groups, a separating algebra is a subalgebra which separates the orbits. In this talk, we prove that there can exist polynomial separating algebras only when the group is generated by reflections. We thus generalize the classical result of Serre that only reflection groups may have a polynomial ring of invariants.

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Centralizers of finite subgroups in non-linear simple locally finite groups

Kıvanç Ersoy

Hartley and Kuzucuoglu proved in [2, Theorem A2] that in an infinite simple locally finite group, the centralizer of every element is infinite. Hartley asked the following question in [1]:

Question 1. *Let G be a non-linear simple locally finite group and F be a finite subgroup of G . Is $C_G(F)$ necessarily infinite?*

We try to answer a stronger version of Hartley's question:

Question 2. *Determine all non-linear simple locally finite groups G and finite subgroups $F \leq G$ such that the centralizer of F in G has an abelian subgroup isomorphic to a direct product of cyclic groups of order p_i for infinitely many prime p_i .*

The non-linear simple locally finite groups are studied by using Kegel covers, whose factors are finite simple groups:

Definition. Let G be a locally finite group. A set $\{(G_i, N_i) : i \in I\}$ consisting of pairs of subgroups of G is called a **Kegel cover** of G if $G = \bigcup_{i \in I} G_i$, the factors G_i/N_i are finite simple groups and $G_i \cap N_{i+1} = 1$.

Here, since G_i/N_i 's are finite simple groups, by the Classification of Finite Simple Groups, we know that each factor is either an alternating group, or a simple group of Lie type, or a sporadic group. Since there are only finitely many sporadic groups, for any locally finite group G there exist a Kegel cover whose factors are either alternating groups or simple groups of Lie type.

Indeed, for a simple locally finite group G , there are only 4 possible cases:

1. G has a Kegel cover with all G_i/N_i 's are alternating groups, or,
2. G has a Kegel cover with all G_i/N_i 's are a fixed type classical group with unbounded rank parameters, or,
3. G has a Kegel cover with all G_i/N_i 's are a fixed type classical group with bounded rank parameters, or,
4. G has a Kegel cover with all G_i/N_i 's are a fixed type exceptional groups.

In cases (3) and (4), the group is linear. So, if we have a non-linear simple locally finite group, then the Kegel cover is either alternating type or a fixed classical type with unbounded rank parameters.

Definition. A Kegel cover $\mathcal{K} = \{(G_i, N_i) : i \in I\}$ is called a **split Kegel cover** if $C_{G_i/N_i}(K/N_i) = C_{G_i}(K)N_i/N_i$ for every subgroup K of G_i .

We need a general notion of a semisimple element in a simple locally finite group:

Definition. Let G be a non-linear simple locally finite group and

$$\mathcal{K} = \{(G_i, N_i) : i \in I\}$$

be a Kegel cover for G . An element x in G is called \mathcal{K} -**semisimple** if \mathcal{K} is a Kegel cover of alternating type or G_i/N_i is a finite simple group of Lie type and xN_i is a semisimple element of G_i/N_i for every $i \in I$.

We obtained the following result:

Theorem. *Let G be a non-linear simple locally finite group with a split Kegel cover \mathcal{K} and F be any finite subgroup of G consisting of \mathcal{K} -semisimple elements. The centralizer $C_G(F)$ contains an infinite abelian subgroup isomorphic to a direct product of cyclic groups of order p_i for infinitely many prime p_i .*

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Quasi-permutation representations of nilpotent groups

Ghodrat Ghaffarzadeh

By a quasi-permutation matrix we mean a square matrix over the complex field \mathbb{C} with non-negative integral trace. Thus every permutation matrix over \mathbb{C} is a quasi-permutation matrix. For a given finite group G , let $p(G)$ denote the minimal degree of a faithful permutation representation of G (or a faithful representation of G by permutation matrices), let $q(G)$ denote the minimal degree of a faithful representation of G by quasi-permutation matrices over the rational field \mathbb{Q} , and let $c(G)$ denote the minimal degree of a faithful representation of G by complex quasi-permutation matrices. It is easy to see that $c(G) \leq q(G) \leq p(G)$ where G is a finite group. Following a problem from Brian Hartley (see [4]), we would like to calculate $c(G)$, $q(G)$ and $p(G)$ for nilpotent groups.

Let G be a finite nilpotent group. Then $G = P_1 \times \cdots \times P_r$, where P_i 's are Sylow subgroups of G . Here we will show that

$$p(G) = p(P_1) + \cdots + p(P_r),$$

and if $|G|$ is odd, then

$$c(G) = c(P_1) + \cdots + c(P_r) \quad \text{and} \quad q(G) = q(P_1) + \cdots + q(P_r).$$

In general two last equations are not hold for nilpotent groups of even order. For example in [1], it is shown that if $G = C_2 \times C_3$, then $c(G) = q(G) = 4$. Also in [3] it is shown that, when G is a generalized quaternion group, then

$$2c(G) = q(G) = p(G).$$

So one can easily see that $c(Q_8 \times C_2 \times C_3) = 8$ and $q(Q_8 \times C_2 \times C_3) = 12$. For this reason we restrict ourselves to groups of odd order.

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The Euler class of a subset complex

Aslı Güçlükan İlhan

This is a joint work with E. Yalçın. Let G be a finite group. The subset complex $\Delta(G)$ is defined as the simplicial complex whose simplices are nonempty subsets of G . The oriented chain complex of $\Delta(G)$ gives a $\mathbb{Z}G$ -module extension of \mathbb{Z} by $\tilde{\mathbb{Z}}$ where $\tilde{\mathbb{Z}}$ is a copy of integers on which G acts via the sign representation of the regular representation. The extension class $\zeta_G \in \text{Ext}_{\mathbb{Z}G}^{|G|-1}(\mathbb{Z}, \tilde{\mathbb{Z}})$ of this extension is called the Ext class of the subset complex of G . This class was first introduced by Reiner and Webb [2] who also raised the following question: What are the finite groups for which ζ_G is nonzero?

In [1], we answer this question completely. We show that ζ_G is nonzero if and only if G is an elementary abelian p -group or G is isomorphic to $\mathbb{Z}/9$, $\mathbb{Z}/4 \times \mathbb{Z}/4$, or $(\mathbb{Z}/2)^n \times \mathbb{Z}/4$ for some integer $n \geq 0$. We obtain this result by first showing that ζ_G is zero when G is a nonabelian group, then by calculating ζ_G for specific abelian groups. The key ingredient in the proof is an observation by Mandell which says that the Ext class of the subset complex is the Euler class of the augmentation module of the regular representation.

We also give some applications of our results to group cohomology, and to the existence of Borsuk-Ulam type theorems.

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Stabilizer quantum codes via codes over Σ_{2m}

Murat Güzeltepe

This is joint work with Mehmet Özen (ozen@sakarya.edu.tr, www.mehmetozen.com). We obtain stabilizer quantum code by using additive codes over the group $\Sigma_{2m} = \mathbb{Z}_{2m} + \alpha\mathbb{Z}_{2m} + \beta\mathbb{Z}_{2m} + \gamma\mathbb{Z}_{2m}$, where $\alpha = 1+i$, $\beta = 1+j$, $\gamma = 1+k$. The multiplicative structure of the Pauli group G_1 on 1 qubit becomes the additive structure of Σ_2 for $m = 1$. Using this argument, a relationship is obtained between the generator matrix of a additive code over the group Σ_2 and the stabilizer generators of the quantum code. The relationship is given in the following table, giving the elements of the group Σ_2 which correspond to the elements of the Pauli group G_1 .

1	$-I$	$1+k$	Y	$1+j+k$	iX
i	$-X$	$i+j$	$-iY$	$i+j+k$	iI
j	$-Z$	$i+k$	$-iZ$	$1+i+j+k$	$-iI$
k	$-Y$	$j+k$	$-iX$		
$1+i$	X	$1+i+j$	iY		

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Rings with radically perfect prime ideals

Sevgi Harman

We say an ideal I of a ring R is radically perfect if among the ideals of R whose radical is equal to the radical of I , the one with the least number of generators has this number of generators equal to the height of I . It is shown that over a valuation domain R of finite Krull dimension, each prime ideal of $R[X]$ is radically perfect if and only if R is of dimension one and the maximal ideal of R is the radical of a principal ideal. We also show that if R is a finite dimensional valuation domain with maximal ideal M , then $MR[X]$ is radically perfect implies that $\text{Spec}R[X]$ is coprimely packed. Finally, we prove that over any local domain R of finite Krull dimension, the polynomial ring $R[X]$ has the property that each maximal ideal of maximal height is the j -radical of a single element; and that if R is a finite dimensional integral domain with coprimely packed set of maximal ideals then each maximal ideal of $R[X]$ of maximal height is the j -radical of an ideal generated by at most two elements.

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Hyperkahler manifolds with holomorphic circle actions

Mustafa Kalafat

We show that a complete simply-connected hyperkahlerian 4 manifold with an isometric triholomorphic circle action is obtained from the Gibbons-Hawking ansatz with some suitable harmonic function. This is joint work with Justin Sawon.

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p -power points and modules of constant p -power Jordan type

Semra Öztürk Kaptanoğlu

Let $k[G]$ be the group algebra of a finite abelian p -group G over an algebraically closed field of characteristic p . We define p -power points and give a characterization of them. Using p -power points we define modules of constant p -power Jordan type as a generalization of modules of constant Jordan type. Endotrivial $k[G]$ -modules are examples of constant p -power Jordan type modules. We give examples of non-isomorphic modules of constant p -power Jordan type having the same constant Jordan type.

Main reference for this work is [1].

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The lattice of fully invariant submodules of cotorsion p -adic module

Tariel Kemoklidze

The report deals with questions of abelian group theory and the term group always means an additively written abelian group. The notation and terms used in the report are taken from the monographs [1], [2].

p denotes a fixed prime number. Z and Q are respectively the groups of integer and rational numbers. A subgroup B of the group A is called fully invariant if every endomorphism of A maps B into B . Such are, for example, subgroups $nA = \{na | a \in A\}$, $A[n] = \{a | na = 0, a \in A\}$, $n > 0, n \in Z$, the torsion part of the group A .

The investigation of the lattice of fully invariant subgroups of a group is an important task of the theory of abelian groups. The problem was studied by R.Baer, I.Kaplansky, A.Mader, A.Moskalenko, S.Grinshpon, and others in different classes of abelian group. Little is known the lattice of fully invariant subgroups of cotorsion group. A group A is called cotorsion if any extension by a torsion free group C splits i.e. $\text{Ext}(C, A) = 0$. Denote that (see [1, §§54,55]) for every A and B groups $\text{Ext}(A, B)$ is cotorsion and every reduced cotorsion group G is isomorphically embeddable into the group $G^\bullet = \text{Ext}(Q/Z, G)$ called the cotorsion hull of the group G . If T torsion part of group G and T is represented as a direct sum of p -components $T = \bigoplus T_p$, then G will be represented as a direct product $G \cong \prod T_p^\bullet \oplus C_p$ thus the study of cotorsion groups is reduced to a considerable extent to the study of group

$$A = T^\bullet \bigoplus C \quad (*)$$

where $T^\bullet = \text{Ext}(Z(p^\infty), T)$, is a cotorsion hull of p -group T , and C is an Algebraically compact torsion free group. T^\bullet, C and also A groups, are p -adic modules too.

By the p - indicator of the element a of group A is called an increasing sequence of ordinal numbers $H(a) = (h(a), h(pa), \dots, h(p^n a), \dots)$ where h denotes the generalized p -height of the element, i.e. $h(a) = \sigma$ if $a \in p^\sigma A \setminus p^{\sigma+1} A$ and $h(0) = \infty$. In the set of a indicators the order is determined this way $H(a) \leq H(b) \iff h(p^i a) \leq h(p^i b), i = 0, 1, \dots$

A reduced p -group is called fully transitive if for arbitrary elements a and b , when $H(a) \leq H(b)$, there exists an endomorphism φ of the group such that $\varphi a = b$. In fully transitive groups the lattice of fully invariant subgroups is usually studied with the aid of indicators. When T is torsion complete group or a direct sum of cyclic p -group, then corresponding A.Mader [4] and A.Moskalenko [5] showed that cotorsion hull T^\bullet is fully transitive and with the help of indicators they described the lattice of fully invariant subgroups of T^\bullet . A.Mader indicated the generalized five conditions. In the case of fullfilment a description the lattice of fully invariant submodules will be given. The direct sum of torsion - complete group is a natural generalization of direct sums of cyclic p -groups and torsion-complete groups. As the author has shown in [3] in this class of groups the torsion hull is not fully transitive if the sum is infinite. Thus the only use of indicators for description of fully invariant subgroups of T^\bullet is not enough.

In this report the elements of group T^\bullet , when $T = \bigoplus_{i=1}^{\infty} \bar{B}_i$ is countable direct sum of torsion complete groups, is written as a sequence $a = (a_0, a_1 + T, a_2 + T, \dots)$, with $(b_j)_{j \geq 0}$ is denoted the sequence of elements of basic subgroup $B = \bigoplus_{i=1}^{\infty} B_i$ (see [5]). As we denote $\pi_i(b_j) = b_{ij}, i = 1, 2, \dots$ projections on i direct summand, we build the set Ω of matrices which are consisted by the indicators. According this we'll build Ω^\bullet semilattice with the required properties. When in (*) group T is a countable direct sum of torsion complete p -groups and C is an Algebraically compact torsion - free group, then the following theorem is true

Theorem. *The lattice of fully invariant submodules of reduced cotorsion p -adic modul A is isomorphic to the lattice of filters of a semilattice Ω^\bullet*

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Integrally indecomposable polytopes in \mathbb{R}^n

Fatih Koyuncu

Being given by G. C. Shephard and P. McMullen, there are some criteria for the homothetic indecomposability, in the sense of Minkowski sum, of polytopes with respect to strong chain of homothetically indecomposable faces. Here, we modified and strengthened these criteria by considering complete chain of integrally indecomposable faces instead of strong chain of homothetically indecomposable faces. Consequently, we obtained new infinite families of integrally indecomposable polytopes in \mathbb{R}^n .

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Isomorphisms and elementary equivalence of locally nilpotent matrix groups and rings

V.M. Levchuk

The model-theoretic study of linear groups and rings initiated by A.I. Mal'cev is closely related to isomorphism theory. For different triangular matrix rings and associated Lie and Jordan rings and also adjoint groups we consider isomorphisms and the elementary equivalence, see also [1], [2]. Further we consider local automorphisms and derivations.

The work is supported by the Russian Foundation for Basic Research (grant 09-01-00717).

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Understanding polynomial invariants of nonabelian p -groups

Uğur Madran

Let G be a finite group with a faithful representation $\rho : G \rightarrow \text{GL}(V)$ over a finite field \mathbb{F} . This action induces a linear action on the polynomial ring $\mathbb{F}[V]$ which may be regarded as the symmetric algebra of the dual vector space, $S(V^*)$. Describing $\mathbb{F}[V]^G$ is of fundamental importance and when $|G| \notin \mathbb{F}^\times$ extra difficulties appear, in general. The well-known Noether number, the maximum degree of a polynomial in a minimal generating set, can be arbitrarily large compared to the group order in this specific case, where $\text{char } \mathbb{F}$ divides $|G|$.

As, $\text{UT}(n, \mathbb{F})$ -the group of upper triangular unipotent matrices, is a Sylow p -subgroup of $\text{GL}(n, \mathbb{F})$ and the invariant ring $\mathbb{F}[V]^{\text{UT}(n, \mathbb{F})}$ form a polynomial ring, it is reasonable to consider invariants of p -groups. Cyclic groups of order prime power p^α and their invariants are studied in the literature, but only a little is known for the general case.

In this talk, we will describe a generic method to compute invariants of nonabelian p -groups by considering a non-trivial and faithful 4 dimensional representations of a p -group of order p^3 where $p \geq 5$ is a prime.

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Rings which are generated by their units: a graph theoretical approach

Hamidreza Maimani

The ring $\mathbb{Z}_2 \times \mathbb{Z}_2$, having only one unit, cannot be generated by its units. It turns out, in the general theory of rings, that this is essentially the only example. In this talk, we give an elementary proof of “A finite commutative ring with nonzero identity is generated by its units if and only if it cannot have $\mathbb{Z}_2 \times \mathbb{Z}_2$ as a quotient.” The proof uses graph theory, and offers, as a byproduct, that in this case, every element is the sum of at most three units.

This is a joint work S. Yassemi and M. R. Pournaki.

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Idempotents of complete semigroups of binary relations defined by semilattices of the class $\Sigma_7(X, 6)$

Sh. Makharadze

This is joint work with N. Rokva.

Let X be an arbitrary nonempty set, D be an X -semilattice of unions, i.e., a nonempty set of subsets of the set X which is closed with respect to operations of the set-theoretic union of elements from D , f be an arbitrary mapping of the set X in the set D . To every such mapping f we put into correspondence such a binary relation α_f on the set X that satisfies the condition

$$\alpha_f = \bigcup_{x \in X} (\{x\} \times f(x)).$$

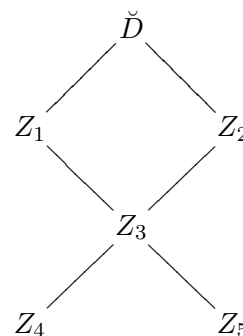
The set of all such α_f ($f : X \rightarrow D$) is denoted by $B_X(D)$. It can be easily proved that $B_X(D)$ is a semigroup with respect to the operation of multiplication which is called a complete semigroup of binary relations defined by the X -semilattice of unions D [1].

Let $\Sigma_7(X, 6)$ be a class of all X -semilattices of unions whose every element is isomorphic to an X -semilattice of unions $D = \{Z_5, Z_4, Z_3, Z_2, Z_1, \check{D}\}$ which satisfies the following conditions:

$$\begin{aligned} Z_4 \subset Z_3 \subset Z_1 \subset \check{D}, \quad Z_4 \subset Z_3 \subset Z_2 \subset \check{D}, \quad Z_5 \subset Z_3 \subset Z_1 \subset \check{D}, \\ Z_5 \subset Z_3 \subset Z_2 \subset \check{D}, \quad Z_1 \setminus Z_2 \neq \emptyset, \quad Z_2 \setminus Z_1 \neq \emptyset, \quad Z_4 \setminus Z_5 \neq \emptyset, \\ Z_5 \setminus Z_4 \neq \emptyset, \quad Z_4 \cup Z_5 = Z_3, \quad Z_1 \cup Z_2 = \check{D}. \end{aligned} \quad (\dagger)$$

The diagram of a semilattice satisfying the conditions (\dagger) is shown in the figure.

In the paper we study the class of semigroups, which consists of all such semigroups $B_X(D)$ which are defined by some semilattice D belonging to the class $\Sigma_7(X, 6)$. The construction of idempotents and maximal subgroups is described for semigroups of the considered class [2, 3]. Formulas are found for calculating the number of idempotents for a finite set X .



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Gluing and non-decreasing Hilbert functions

Pınar Mete

In this talk, by using the technique of gluing semigroups, we give infinitely many families of 1-dimensional local rings with non-decreasing Hilbert functions generalizing the results in [1]. More significantly, these are local rings whose associated graded rings are not necessarily Cohen-Macaulay. In this sense, we give an effective technique to construct large families of 1-dimensional Gorenstein local rings associated to monomial curves, which support Rossi's conjecture saying that every Gorenstein local ring has non-decreasing Hilbert function.

This is a joint work with Feza Arslan of METU and Mesut Şahin of Atılım University [2].

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On extensions of a valuation on K to $K(x)$

Figen Öke

Let v be a valuation of a field K , G_v its value group and k_v its residue field and w be an extension of v to $K(x)$. w is called an residual transcendental extension of v if k_w/k_v is a transcendental extension and w is called residual algebraic extension of v if k_w/k_v is an algebraic extension. In this study residual transcendental and residual algebraic extensions of v to $K(x)$ are represented.

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4-Manifolds

Mehmetcik Pamuk

Let M be a topological 4-manifold whose fundamental group is either a free group or a surface group. In this talk we will give a classification of such 4-manifolds up to s -cobordism by studying the group of homotopy classes of homotopy self-equivalences.

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Equivariant CW-complexes and the orbit category

Semra Pamuk

This is a joint work with Ian Hambleton and Ergün Yalçın. I will give a general framework for studying G -CW complexes via the orbit category. As an application we show that the symmetric group $G = S_5$ admits a finite G -CW complex X homotopy equivalent to a sphere, with cyclic isotropy subgroups.

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Quadric-line arrangements and ball quotients

Celal Cem Sarioğlu

In this talk, we will give some new examples of orbifolds based on quadric-line arrangements on \mathbb{P}^2 uniformized by the complex 2-ball \mathbb{B}_2 , and exhibit the covering relations between them.

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On a Diophantine equation

Gökhan Soydan

The object of this talk is to give all the solutions of the Diophantine equation

$$x^2 + 3^a \cdot 11^b = y^n,$$

in nonnegative integers $a, b, x \geq 1, y \geq 1, k \in \mathbb{N}, n \geq 3$. The computations are done with MAGMA [3]. (This talk is based on the references [2], [1], [4], [5]).

This is joint work with Musa Demirci, İsmail Naci Cangül (Uludağ University) and Nazlı Yıldız İkikardeş (Balıkesir University).

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Toric ideals of simple surface singularities

Mesut Şahin

A fundamental problem about toric ideals is to give an upper bound for the maximum degree of binomials in a Gröbner basis. Toric ideals of projectively normal toric varieties V are known to be generated by homogeneous binomials of degree at most $n = \dim V$, [1, Theorem 13.14]. But it is still an open problem in general if they have a Gröbner basis consisting of homogeneous binomials of degree at most n , see [1, p.136]. A similar problem has recently studied in [2] for simplicial homogeneous toric ideals which are not necessarily normal. Among other important results, they have provided an affirmative answer to this problem in the case of *simplicial, normal* projective toric varieties, see [2, Corollary 3.8].

In this talk, we will present a class of toric varieties arising from simple surface singularities whose reduced Gröbner basis has interesting properties. First of all, homogeneous toric ideals of projective closures of these varieties have Gröbner bases consisting

of large number of binomials (changing with respect to n) whose degree are bounded by 4. Comparing to the given bound n , the toric ideals corresponding to rational singularities considered here have a very small and constant bound 4 giving signs of justification of their special place in the classification of singularities of surfaces. On the other hand, the initial ideals of toric ideals in the affine case are squarefree which has nice consequences indicated in [3].

This is a joint work with Pınar Mete of Balıkesir University and Gülay Kaya of Galatasaray University.

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Array codes and m-spotty weights

İrfan Şiap

In this work, we introduce m-Spotty weights for array codes. In order to establish this objective, we first relate array codes with codes over the ring $R = F_q[x]/(x^s - 1)$. With respect to this identification we are able to manipulate array codes and further define a duality concept for array codes so called φ -duality. Finally, we also prove a MacWilliams identity with respect to this duality for m-Spotty weight enumerators.

Byte error control codes play an important role in computer memory systems that use chips with 4-bit I/O data [11]. Recently, high-density RAM chips with wide I/O data of 8,16 and 32 bits have also found applications. These chips are quite vulnerable to multiple random error bits while being exposed to strong electromagnetic waves, radio active particles, etc. Due to these facts, in order to be able to correct multiple errors a new spotty byte error called m-spotty byte error is introduced in [13] for binary codes. Construction of codes correcting byte errors and properties of such codes are also investigated. Some of related work can be found in [5],[12],and [13].

Recently, a MacWilliams identity has been proven for m -spotty byte error codes [14]. In [1], Bachoc considered linear codes over the ring $F_p + uF_p$ (p prime) and constructed modular lattices by making use of linear codes over these rings. On the other hand, array

codes has been use in several applications for example in [6] and [10]. Burst errors of array codes are also investigated in [7] and [8].

Thus, in this paper, we introduce m -byte errors on linear codes over the ring R , relate this to array codes and establish a MacWilliams type identity for m -spotty weight enumerators.

A linear code C of length n over R is defined to be an additive submodule of the R -module R^n . The elements of C are called codewords.

The Hamming weight w of a codeword c is the number of nonzero places of the codeword c and is denoted by $w(c)$. The Hamming distance between the codewords c and v is defined by $d(c, v) = w(c - v)$.

Now, we give the definition of m -spotty weight of a codeword c .

Let $c = (c_{11}, c_{12}, \dots, c_{1b}, \dots, c_{n1}, c_{n2}, \dots, c_{nb}) \in R^{bn}$ be a codeword of length $N = bn$. The first byte of c is the first b entries denoted by $c_1 = (c_{11}, c_{12}, \dots, c_{1b})$. Hence, the i -th byte of c will be denoted by $c_i = (c_{i1}, c_{i2}, \dots, c_{ib})$.

Definition. [5] An error e is called a spotty byte error or t/b -error if t or fewer bits within a b -bit byte are in error, where $1 \leq t \leq b$.

Now, we extend the definition of m -spotty weights originally introduced in [13] for binary codes to codes over R .

Definition. Let e be an error vector and e_i be the i -th byte of e where $1 \leq i \leq n$. The number of t/b -errors in e , denoted by $w_M(e)$, and called m -spotty weight is defined as

$$w_M(e) = \sum_{i=1}^n \left\lceil \frac{w(e_i)}{t} \right\rceil.$$

If $t = 1$, then $w_M(e) = w(e)$. Hence, the m -spotty weight coincides with the usual Hamming weight.

In a similar way, we define the m -spotty distance of two codewords c and v as $d_M(c, v) = \sum_{i=1}^n \left\lceil \frac{d(c_i, v_i)}{t} \right\rceil$. Further, it is also straightforward to show that this distance is a metric in R^N .

Array Codes Obtained From Codes over the Ring R and Duality

Let C be an array code such that $C \subset M_{n \times s}(F_q)$ and let $c = (c_{ij}) \in C$. We define a map

$$\varphi: R^s \rightarrow C: (c_{11} + c_{21}x + \dots + c_{n1}x^{n-1}, \dots, c_{1s} + c_{2s}x + \dots + c_{ns}x^{n-1}) \mapsto (c_{ij}).$$

It is clear that the map φ is an F_q -vector isomorphism. We are going to let the codes over R to be an R modules in order to have a richer structure. Further, if C is a linear code over R , then its image $\varphi(C)$ is an F_q -subspace of array codes. Also, m -spotty errors correspond to burst errors in the image. So, burst errors for array codes defined in [7] and [8] are also covered in this case.

Let $c = (c_1, c_2, \dots, c_n)$ and $v = (v_1, v_2, \dots, v_n)$ be two elements of R^n . An inner product of the elements c and v is defined by $\langle c, v \rangle = \sum_{i=1}^n c_i v_i$.

Let C be a linear code. The set $C^\perp = \{v \in R^n | \langle c, v \rangle = 0 \text{ for all } c \in C\}$ is also a linear code and it is called the dual code of C .

The m -spotty weight enumerator of a linear code C is defined by

$$A(z) = \sum_{c \in C} z^{\frac{w_M(c)}{t}}.$$

Since $\sum_{j=0}^b [j/t] \cdot \alpha_j$ gives the m -spotty weight of a codeword, we have

$$A(z) = \sum_{\substack{\alpha_0, \alpha_1, \dots, \alpha_b \geq 0 \\ \alpha_0 + \alpha_1 + \dots + \alpha_b = n}} A_{\bar{\alpha}} \prod_{j=0}^b \left(z^{[j/t]} \right)^{\alpha_j}$$

where $\bar{\alpha} = (\alpha_0, \alpha_1, \dots, \alpha_b)$ denotes the distribution of bitwise Hamming weights of a codeword where α_i counts the number of bits that have weights equal to i and $A_{\bar{\alpha}}$ gives the number of codewords of weight distribution $\bar{\alpha}$.

We conclude the paper by establishing a MacWilliams Identity between array codes and their so called φ -duals.

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Type B plactic relations for r-domino tableaux

Müge Taşkın

The recent work of Bonnafé *et al.* (2007) shows through two conjectures that r-domino tableaux have an important role in Kazhdan-Lusztig theory of type B with unequal parameters. In this paper we provide plactic relations on signed permutations which determine whether given two signed permutations have the same insertion r-domino tableaux in Garfinkle's algorithm (1990). Moreover, we show that a particular extension of these relations can describe Garfinkle's equivalence relation on r-domino tableaux which is given through the notion of open cycles. With these results we enunciate the conjectures of Bonnafé *et al.* and provide necessary tool for their proofs.

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Notes on a generalization of local cohomology modules

Abolfazl Tehranian

Throughout this talk, R is a commutative Noetherian ring and I, J are ideals of R . The generalized local cohomology module with respect to a pair of ideals I, J of R is introduced by Takahashi–Yoshino [1]. Let t be a non–negative integer. Let M be an R –module such that $Ext_R^t(R/I, M)$ is a finite R –module. If t is the first integer such that the local cohomology module with respect to (I, J) is non– (I, J) cofinite, then we show that $Hom_R(R/I, H_{I,J}^t(M))$ is finite. Also we study the finiteness of $Ext_R^1(R/I, H_{I,J}^t(M))$ and $Ext_R^2(R/I, H_{I,J}^t(M))$.

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The automorphism group of an infinitely generated free nilpotent group is complete

Vladimir Tolstykh

Baumslag conjectured in the 1970s that the automorphism tower of a finitely generated free nilpotent group must be very short. Let $F_{n,c}$ denote a free nilpotent group of finite rank $n \geq 2$ and of nilpotency class $c \geq 2$. In 1976 Dyer and Formanek [1] proved that the automorphism group of $F_{n,2}$ is even complete (and hence the height of the automorphism tower of $F_{n,2}$ is two) provided that $n \neq 3$; in the case when $n = 3$, the height of the automorphism tower of $F_{n,2}$ is three. The main result of [2] states that the automorphism group of any infinitely generated free nilpotent of class two is complete. In his Ph. D. thesis [3] Kassabov found an upper bound $u(n, c)$ (a natural number) for the height of the automorphism tower of $F_{n,c}$ in terms of n and c , thereby finally proving Baumslag's conjecture. By analyzing the function $u(n, c)$, one can conclude that if c is small compared to n , then the height of the automorphism tower of $F_{n,c}$ is at most three.

In our talk we shall present the sketch of the proof of the following result.

Theorem. *The automorphism group of any infinitely generated free nilpotent group is complete.*

Thus the automorphism tower of any free nilpotent group terminates after finitely many steps.

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Indecomposable cycles (on product of varieties)

İnan Utku Türkmen

For any complex algebraic variety X , singular cohomology is not sensitive enough to study this object algebraically hence one needs a more algebraic homology theory namely, the Chow homology $CH^\bullet(X)$, which is a ring built from subvarieties of X and intersection theory. However it is difficult to compute these groups, so one has to look at maps from $CH^r(X)$ to more computable (co)homology theories. such maps are called regulators.

One of the major development in study of regulators is Grothendieck's invention of algebraic K theory, $K_0(X)$. This object is related with X in terms of vector bundles on X and Grothendieck's Reimann-Roch theorem, given above, provides a new way to interpret these two objects, $K_0(X)$ and $CH^r(X)$:

$$K_0(X) \otimes \mathbb{Q} \simeq CH^\bullet(X) \otimes \mathbb{Q}$$

After Quillen's generalization of Grothendieck's construction to higher K groups ($K_m(X)$), the missing analog on the cycles side is completed by Spencer Bloch's invention of higher Chow groups ($CH^r(X, m)$). Bloch's version of Reimann-Roch theorem;

$$K_m(X) \otimes \mathbb{Q} \simeq CH^r(X, m) \otimes \mathbb{Q}$$

completed the full generalization of Grothendieck's Reimann-Roch theorem.

Independently from each other, Bloch using his higher Chow groups ($CH^r(X, m)$), and Beilinson using higher K groups ($K_m(X)$), constructed regulator maps;

$$CH^r(X, m) \rightarrow H^{2r-m}(X, r)$$

to a reasonable, computable cohomology theory $H^{2r-m}(X, r)$

In this talk I will present the some of the fundamental concepts and techniques to study higher Chow groups via regulator maps to Delign cohomology. I will mention some results about the some properties of the group $CH^r(X, m)$ in the case X is a product of elliptic curves, which are joint work with Prof. James Lewis from University of Alberta, Canada.

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Flag-transitive subgroups of the linear group over a skew field

Sergey Zyubin

Let K be a (commutative or skew) field and $PG(n, K)$ be a projective space over K . The projective linear group $PGL_{n+1}(K)$ naturally acts on $PG(n, K)$. Under this action, the classical group $PSO_{n+1}(\mathbb{R})$ over the real field \mathbb{R} acts transitively on the projective space $PG(n, \mathbb{R})$. Moreover it acts flag-transitively, i.e. it moves a maximal flag of the projective space to any other one. Another example of a flag-transitive subgroup of the projective linear group is the subgroup $PSL_n(\mathbb{Z})$ of the group $PGL_n(\mathbb{Q})$. P. Neumann and Ch. Praeger posed a problem [1, Problem 11.70] to describe all flag-transitive subgroups of the projective linear group over an infinite (commutative or skew) field K . They also asked what conditions for a subring R from K provides flag-transitivity of the subgroup $PGL_{n+1}(R)$? The first result gives a required criterion for subrings.

Theorem 1. *Let R be a subring of a (commutative or skew) field K . Then the subgroup $PGL_{n+1}(R)$ acts flag-transitively on the projective space $PG(n, K)$ if and only if R is a (left and right) Bezout ring and its sets of left and right fractions coincide with K .*

The second result provides advance in the posed problem for linear groups of dimension 2 over locally finite fields.

Theorem 2. *Let K be a locally finite field and G be a subgroup of $PGL_2(K)$. If G acts transitively on the projective line $P(1, K)$ then the only following cases are possible:*

- (i) $G = PGL_2(K)$;
- (ii) $G = PSL_2(K)$;
- (iii) G is a maximal subgroup of $PGL_2(K)$ that conjugated over quadratic extension of K to the monomial subgroup;
- (iv) G has index 2 in the subgroup from the previous case.

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3 Posters

Soft sets and soft rings

Ummahan Acar, Fatih Koyuncu, and Bekir Tanay

Molodtsov introduced the concept of soft sets in [7]. Then, Maji et al. defined the some operations on soft sets [6]. Aktas and Çağman defined the notion of soft groups [1]. Finally, soft semirings are defined by Feng et al. in [2]. In this paper, we have introduced the initial concepts of soft rings.

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A note on ideals of IFP near-rings

Akın Osman Atagün, Emin Aygün, and Aslihan Sezgin

A near-ring N is said to fulfill the insertion-of-factors property (IFP) provided that for all $a, b, n \in N$, $ab = 0$ implies $anb = 0$. Let N be a near-ring. If $P \triangleleft N$ and N/P is an IFP near-ring, then P is called an IFP-ideal of N . It is well-known that if N is an IFP near-ring, then for all $x \in N$, $(0 : x)$ (the annihilator of x) is an ideal of N . We know that in general, the union of subgroups is not a subgroup, and therefore the union of ideals is not an ideal, too.

In this study, we have given a condition on an IFP near-ring and then we have obtained that arbitrary unions of annihilators of elements in IFP near-rings are ideals, furthermore IFP-ideals of N .

In [2], Atagün, Sezgin and Taşdemir introduced a new type of N -group, called IFP-type 0 N -group. In this note, we have also characterized IFP ideals of near-rings with identity by making use of IFP-type 0 N -group. This is illustrated by an example.

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Exact A -exponential groups

M. Amaglobeli and T. Bokelavadze

The notion of an A -exponential G for an associative ring A with unit was introduced by R. Lyndon in [1]. In [2] A. G. Myasnikov gave a more exact definition of an exponential group due to Lyndon by introducing one more additional axiom by which all abelian subgroups of an exponential group G are usual A -modules. In [2] the category of A -exponential groups is introduced in more exact terms and the fundamental principles of the theory of such groups. The systematic exposition is given in [2]–[5].

Let for a ring A and a group G the notion of exponent g^α be uniquely defined for all $g \in G$, $\alpha \in A$. Then G is called an A -exponent group if

- (1) $g^1 = g$, $g^0 = 1$, $1^\alpha = 1$;
- (2) $g^{\alpha+\beta} = g^\alpha \cdot g^\beta$, $g^{\alpha\beta} = (g^\alpha)^\beta$;
- (3) $(h^{-1}gh)^\alpha = h^{-1}g^\alpha h$;
- (4) $[g, h] = 1 \implies (gh)^\alpha = g^\alpha h^\alpha$.

The notion of partial A -exponential group is defined in a natural manner. Let P_A be the category of all such groups. The key operation in the category of A -groups is the notion of tensor completion G^A for any partial A -group G [2]. A group G is called exact with respect to a ring A if the canonical mapping $\lambda : G \rightarrow G^A$ is an embedding. Let us define the class $P_A^0 \subseteq P_A$. $G \in P_A^0$ if the following conditions are fulfilled:

- 1) if M is maximal abelian semigroup G , $x \notin M$, then $M^x \cap M = 1$;
- 2) a canonical mapping $i : M \underset{A}{\otimes} A$ in the category of partial A -modules is an embedding. The following theorem is proved.

Theorem. *Let \mathbb{Z} be a subring of the ring A and the group $G \in P_A^0$. In G and A there no elements of order 2. Then the group G is exact, i.e., the canonical mapping $\lambda : G \rightarrow G^A$ is an embedding.*

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Cobordism group of $(B\mathbb{Z}/p, f)$ manifolds

Mehmet Akif Erdal

Let $\chi_n : \mathbb{Z}/p \rightarrow U(n)$ be a certain n -dimensional faithful complex representation of \mathbb{Z}/p and $i_n : U(n) \rightarrow O(2n)$ be inclusion for $n \geq 1$. Then the compositions $i_n \circ \chi_n$ and $j_n \circ i_n \circ \chi_n$ induce fibrations on $B\mathbb{Z}/p$ where $j_n : O(2n) \rightarrow O(2n+1)$ is the usual inclusion. Let $(B\mathbb{Z}/p, f)$ be a sequence of fibrations where $f_{2n} : B\mathbb{Z}/p \rightarrow BO(2n)$ is the composition $B i_n \circ B \chi_n$ and $f_{2n+1} : B\mathbb{Z}/p \rightarrow BO(2n+1)$ is the composition $B j_n \circ B i_n \circ B \chi_n$. By Pontrjagin-Thom theorem the cobordism group $\Omega_m(B\mathbb{Z}/p, f)$ of m -dimensional $(B\mathbb{Z}/p, f)$ manifolds is isomorphic to $\Pi_m^s(M\mathbb{Z}/p, *)$ where $M\mathbb{Z}/p$ denotes the Thom space of the bundle over $B\mathbb{Z}/p$ that pullbacks to the normal bundle of manifolds in $\Omega_m(B\mathbb{Z}/p, f)$. We will use the Adams Spectral Sequence to get information about $\Omega_m(B\mathbb{Z}/p, f)$.

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Obtaining 3-manifolds by using framed links

Deniz Kutluay

Let L be a framed link whose all components are trivial. Linking numbers of these components will be specified a priori. We shall then follow the general argument of obtaining 3-manifolds by surgery on S^3 in [1] to get an orientable 3-manifold by using L .

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Monomial Burnside ring as a biset functor

Cihan Okay

Given a finite group G , we can realize the permutation modules by the linearization map defined from the Burnside ring $B(G)$ to the character ring of G , denoted $A_K(G)$. But not all KG -modules are permutation modules. To realize all the KG -modules we need to replace $B(G)$ by the monomial Burnside ring $B(C, G)$. We can get information about monomial Burnside ring of G by considering subgroups or quotient groups of G . For this the setting of biset functors is suitable. We can consider the monomial Burnside ring as a biset functor and study the elemental maps: induction, restriction, inflation, deflation and isogation. Among these maps, deflation is somewhat difficult and requires more consideration.

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Real monomial Lefschetz invariants for spheres of real representations

İpek Tuvay

Let X be a finite G -set, consider the permutation $\mathbb{R}G$ -module $M = \mathbb{R}X$ and $S(M)$ be the unit sphere of M . The reduced Lefschetz invariant for X , which is an element of the Burnside ring $B(G)$, is defined to be

$$\tilde{\Lambda}_G(S(M)) = - \bigoplus_{n=-1}^{\infty} (-1)^n [C_n]$$

where C_n is the set of n -simplices of the triangulation of $S(M)$. We discuss a theorem which gives the Lefschetz invariant in terms of the idempotent basis of $\mathbb{Q}B(G)$. This has a connection with the reduced Euler characteristic of the n -sphere \mathbb{S}^n . Then we generalize the reduced Lefschetz invariant to monomial Burnside rings and with the help of this we decompose the tom Dieck map die into a product of two maps.

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Free group actions on manifolds

Özgün Ünlü

Given a compact highly connected manifold M without boundary, one could ask what group theoretic conditions characterize the finite groups that can be realized as the fundamental group of a manifold whose universal cover is M . In case $M = \mathbb{S}^3$ the answer is known. William Thurston's elliptization conjecture, proved by Grigori Perelman, states that only finite subgroups of $SO(4)$, listed in [6], can be realized as the fundamental group of a manifold whose universal cover is \mathbb{S}^3 . Considering the fundamental group of a manifold with universal cover M as the group of deck transformations acting freely on M , the above problem is equivalent to asking what group theoretic conditions characterize the finite groups which can act freely on M . The study of this problem breaks up into two distinct aspects: (1) finding group theoretic restrictions on finite groups that can act freely on M ; and (2) constructing explicit free actions of finite groups on M . In the case when M is a sphere, the problem is called the topological space form problem and both aspects of this problem have been well studied (see [5]). As a natural continuation, one could study the case when M is a product of two equidimensional spheres. In this case we know some restrictions for example the group cannot contain a copy of the elementary abelian group $\mathbb{Z}/p \times \mathbb{Z}/p \times \mathbb{Z}/p$ (see [1]) and cannot contain a copy of the alternating group A_4 (see [7]). As for the second aspect of this problem we have some new methods which have been recently employed in constructing free actions on products of two equidimensional spheres (see [2], [3], and [4]). For example we can construct a free action of the extraspecial 3-group of order 27 and exponent 3 on $\mathbb{S}^5 \times \mathbb{S}^5$.

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7 Notes on Turkish

In alphabetical order, the 29 letters of the Turkish alphabet are:

A B C Ç D E F G Ğ H İ İ J K L M N O Ö P R S Ş T U Ü V Y Z
a b c ç d e f g ğ h ı i j k l m n o ö p r s ş t u ü v y z

Words are spelled as they are spoken. Except in loanwords and as noted just below, there is no variation between long and short vowels. There is hardly any variation between stressed and unstressed syllables.

The **consonants** that need mention are: *c*, pronounced like English *j*; *ç*, like English *ch*; *ğ*, which lengthens the vowel that precedes it (and never begins a word); *j*, as in French; and *ş*, like English *sh*. Doubled consonants are held longer.

As for the **vowels**, the *a* is like *uh* in English; *ö* and *ü* are as in German, or are like the French *eu* and *u*; and *u* is like the short English *oo*. Diphthongs are obtained by addition of *y*: so, *ay* is English long *i*, and *ey* is English long *a*.

The eight vowels exhibit three binary distinctions: **back/front**, **unround/round**, and **close/open**. In use, many words feature a stem followed by one or more suffixes. Often the vowel in a suffix **harmonizes** with preceding vowel: then it resembles the preceding vowel as far as possible while remaining *hard*, or while remaining *unround open*. So one might introduce special symbols for the variable vowels in suffixes, as suggested in the table.

#	ı	back	unround	close
	İ	front		
	u	back	round	
	ü	front		
@	a	back	unround	open
	e	front		
	o	back	round	
	ö	front		

The question *Avrupalılaştıramadıklarımızdan mısınız?* can be analyzed as a stem with 11 suffixes:

Avrupa⁰lı¹la²ş³tır⁴ama⁵dık⁶lar⁷ımız⁸dan⁹ mı¹⁰sınız¹¹?

The suffixes translate mostly as separate words in English, in almost the reverse order: *Are you¹¹ one-of⁹ those⁷ whom⁶ we⁸ could-not⁵ Europeanize (make⁴ be² come³ Europe⁰ an¹)?¹⁰* If we change *Europeanize* to *Turkify*, we get *Türkleştiremediklerimizden misiniz?* Detached, the suffixes might be written l@ş, t#r, @m@, d#k, l@r, #m#z, d@n, m#, s#n#z.

Useful expressions

Lütfen / Teşekkürler / Bir şey değil *Please / Thanks / It's nothing.*

Evet/hayır *Yes/no.* Var/yok *There is / there isn't.* Affedersiniz *Excuse me.*

Efendim *Madam or Sir.** Merhaba *Hello.* Günaydın *Good morning.*

Hoş geldiniz / Hoş bulduk *Welcome / (its response).*

İyi günler/akşamlar/geceler *Good day/evening/night.*

*Efendi is from the Greek *αὐθεντικός*, whence also English *authentic*.

Güle güle *Fare well* (said to the person leaving);

Allaha ısmarladık or Hoşça kalın *Good bye* (said to the person staying behind).

Bay/Bayan *Mr/Ms*, or *gentlemen's/ladies'*. Beyefendi/Hanımefendi *Sir/Madam*.

İtiniz/çekiniz *Push/pull*; giriş/çıkış *entrance/exit*;

sol/sağ *left/right*; soğuk/sıcak *cold/hot*.

Nasılsınız? / İyiyim; siz? / Ben de iyiyim. *How are you? / I'm fine; you? / I'm also fine.*

Elinize sağlık *Health to your hand* (the chef's, who replies: Afiyet olsun *May it be healthy*).

Kolay gelsin *May [your work] come easy*.

Geçmiş olsun *May [your sickness, difficulty, &c.] be over*.

İnşallah *If God wills*; Maşallah or Allah korusun *May God protect*.

Rica ederim *I request*, or Estağfurullah, can be used with the sense of *I don't deserve such praise!* or *Don't say such [bad] things about yourself!*

Sıfır, bir, iki, üç, dört, beş, altı, yedi, sekiz, dokuz 0, 1, 2, 3, 4, 5, 6, 7, 8, 9;

on, yirmi, otuz, kırk, elli, altmış, yetmiş, seksen, doksan 10, 20, 30, . . . , 90;

yüz, bin, milyon, milyar 10^2 , 10^3 , $(10^3)^2$, $(10^3)^3$;

yüz kırk dokuz milyon beş yüz doksan yedi bin sekiz yüz yetmiş 149,597,870.

Daha/en *more/most*; az *less*, en az *least*.

Al-/sat-/ver- *take, buy / sell / give*;

alış/satış/alışveriş *buying (rate)/selling (rate)/shopping*.

İn-/bin-/gir-/çık *go: down, off / onto / into / out, up*;

aşağı/yukarı *lower/upper*; alt/üst *bottom/top*.

Kim, ne, ne zaman, nerede, nereye, nereden, niçin, nasıl, kaç, ne kadar?

who, what, when, where, whither, whence, why, how, how many, how much?

8 Session chairs

Plenary talks

	Wed	Thurs	Fri	Sat	Sun
morning	Adem	Scholl	Avramov	Carlson	de Jeu
afternoon	Ünver	Coşkun		Berkman	

Parallel talks

	Room 1			Room 2		
	Wed	Thurs	Sat	Wed	Thurs	Sat
15.20	M. Sezer	Bilhan	Y. Ünlü	İ. Şiap	Mermut	Barker
16.30	Belegradek	Cangül	Özen	Madran	Öke	Ekici
17.40			Erdoğan			Kuzucuoğlu

9 Timetable

For session chairs, see overleaf.

	Wednesday	Thursday	Friday	Saturday	Sunday	
9.00 9.50	Scholl	Adem	Carlson	Avramov	Ünver	
10.00 10.50	Symonds	Green	de Jeu	Lewis	Shimada	
coffee						
11.20 12.10	İ. Coşkun	Uludağ	Boltje	Domokos		
lunch						
excursion						
14.00 14.50	Nicholson	Kreuzer		Borovik		
coffee						
15.20 16.20	parallel sessions			sessions		
16.30 17.30	parallel sessions			sessions		
	17.40	poster session			sessions	
	18.40					
Room 1			Room 2			
	Wed	Thurs	Sat	Wed	Thurs	Sat
15.20	Degtyarev	Soydan	Tehraniyan	Makharadze	Öke	Koyuncu
15.40	Kalafat	Cangül	Zyubin	Kemoklidze	Atlıhan	Akalan
16.00	M. Pamuk	Güzeltepe	Levchuk	Diasamidze	İ. Şiap	Deveci
16.30	Güçlükan	Şahin	Dufresne	Abbaspour	Kaptanoğlu	O. Coşkun
16.50	F. Altunbulak Sarıoğlu		Madran	Ghafarzadeh	Taşkın	Barker
17.10	Türkmen	Tolstykh	S. Pamuk	Maimani	Çengellenmiş	Atagün
		17.40	Mete			Betin
		18.00	Harman			M. Altunbulak
		18.20				Ersoy